US007823254B2

(12) **United States Patent**
Lin

(10) **Patent No.: US 7,823,254 B2**
(45) **Date of Patent: Nov. 2, 2010**

(54) **HINGE ASSEMBLY**

(75) Inventor: **Chao-Chi Lin**, Taichung (TW)

(73) Assignee: **Leohab Enterprise Co.,Ltd.**, Taichung (TW)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 392 days.

(21) Appl. No.: **12/031,781**

(22) Filed: **Feb. 15, 2008**

(65) **Prior Publication Data**

US 2009/0205170 A1 Aug. 20, 2009

(51) **Int. Cl.**
E05C 17/64 (2006.01)

(52) **U.S. Cl.** **16/337**; 16/330; 16/340

(58) **Field of Classification Search** 16/337–339, 16/342, 330, 374, 376, 377, 340, 303; 361/679.11, 361/679.12, 679.27; 455/90.3, 575.1, 575.3, 455/575.8; 379/433.12, 433.13; 348/373, 348/333.01, 333.06, 794
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,987,060	A *	1/1935	Hammond	16/340
6,108,868	A *	8/2000	Lin	16/340
6,421,878	B1 *	7/2002	Kaneko et al.	16/330
7,082,642	B2 *	8/2006	Su	16/340
7,219,393	B2 *	5/2007	Kida	16/221
7,565,719	B2 *	7/2009	Su	16/337
2005/0066475	A1 *	3/2005	Minami	16/337
2007/0174996	A1 *	8/2007	Lu et al.	16/340

FOREIGN PATENT DOCUMENTS

TW	M556861	10/2003

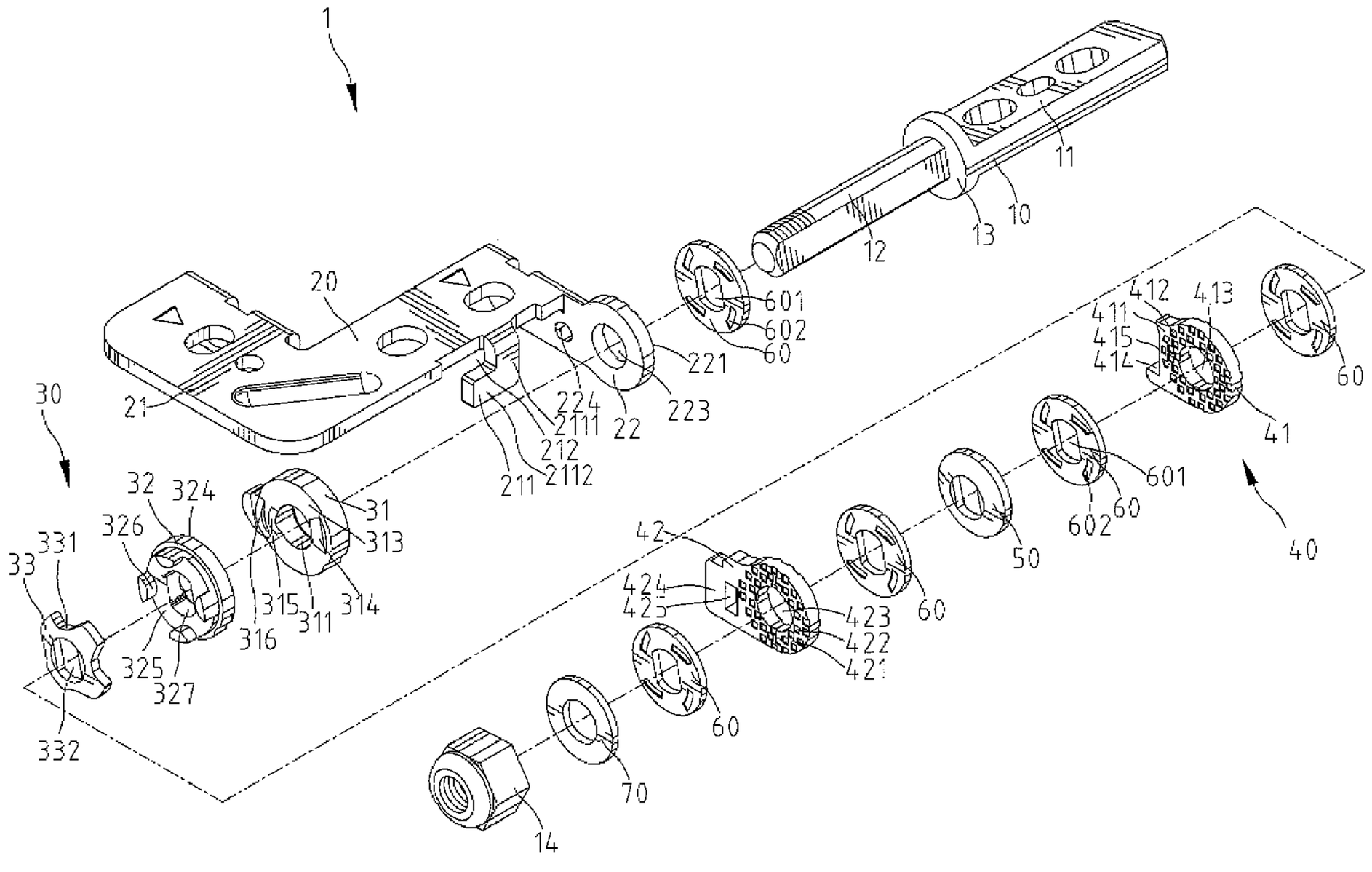
* cited by examiner

Primary Examiner—Chuck Y. Mah
(74) *Attorney, Agent, or Firm*—Alan Kamrath; Kamrath & Associates PA

(57) **ABSTRACT**

A hinge assembly suitable for coupling a notebook computer base to a display includes a first coupling member for coupling to the base and a second coupling member for coupling to the display. A positioning device supports the display at various angular positions relative to the base. A friction device increases resistance to movement throughout the range of motion of the hinge assembly while decreasing torque and pressure load transmitted to the positioning device.

15 Claims, 7 Drawing Sheets



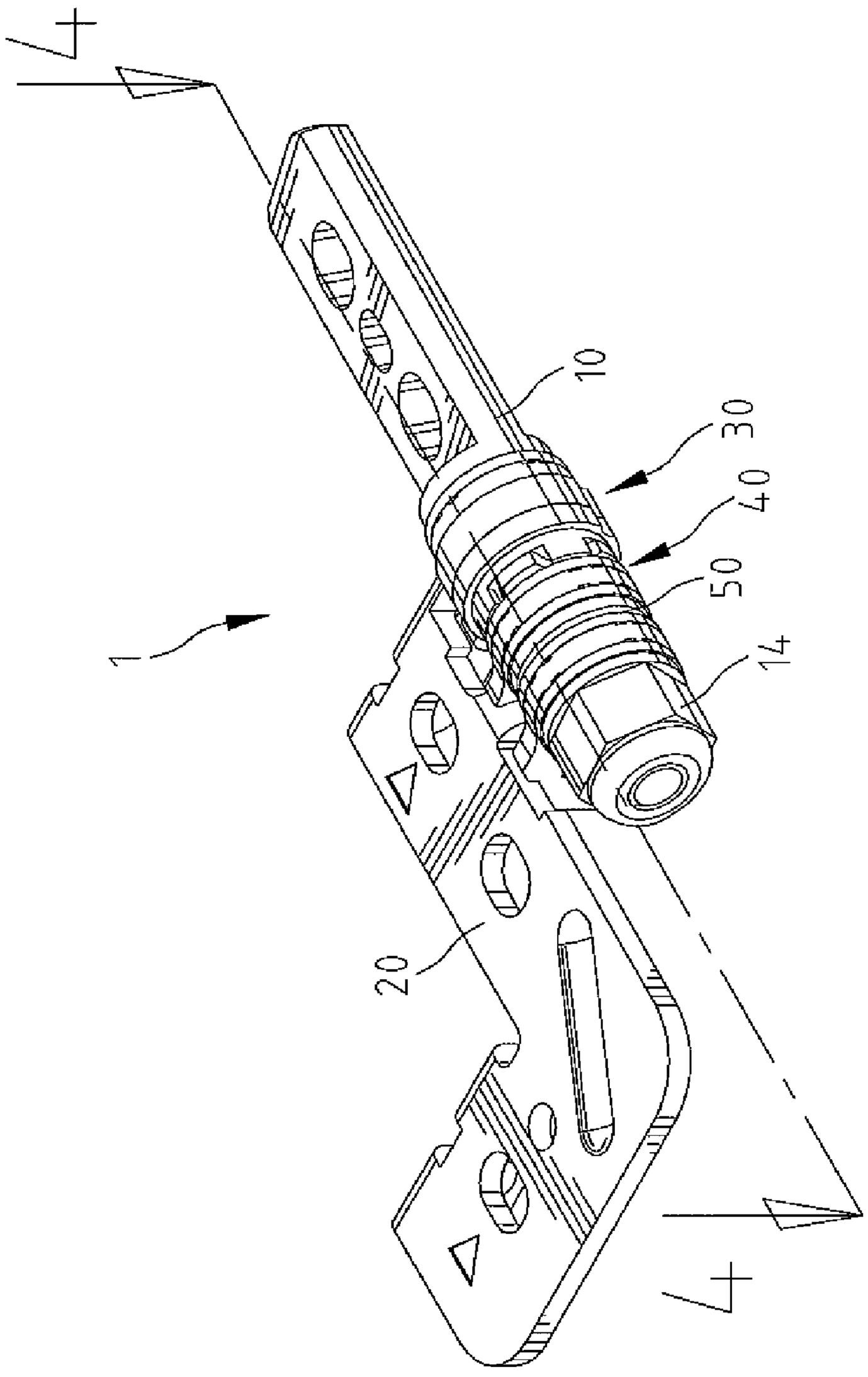


Fig. 1

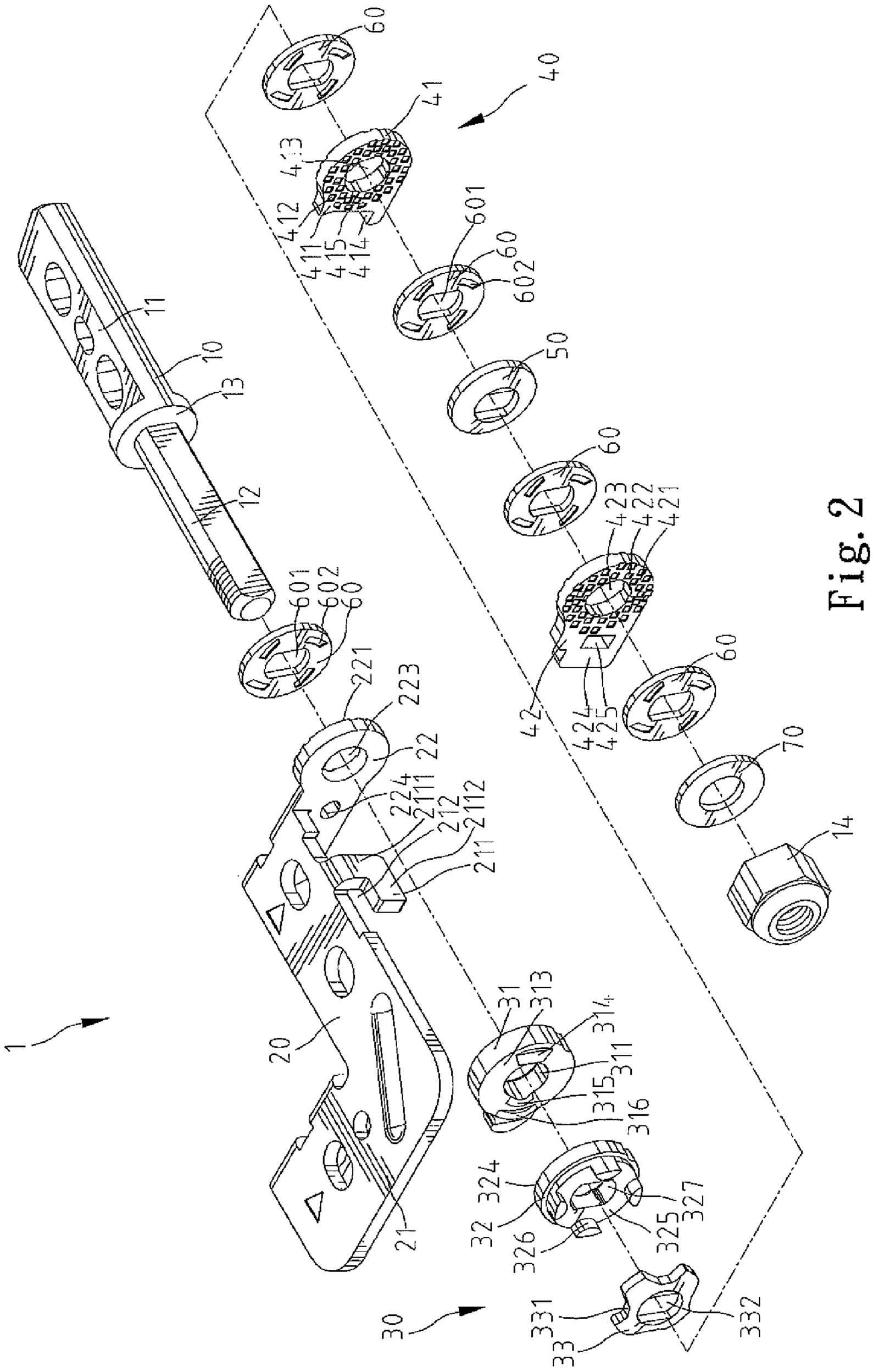

1
10
11
12
13
20
21
30
31
313
314
315
316
311
32
324
326
325
327
331
33
332
40
41
411
412
413
414
415
42
421
422
423
424
425
50
60
601
602
70
14
22
221
223
224
2111
212
2112
211

Fig. 2

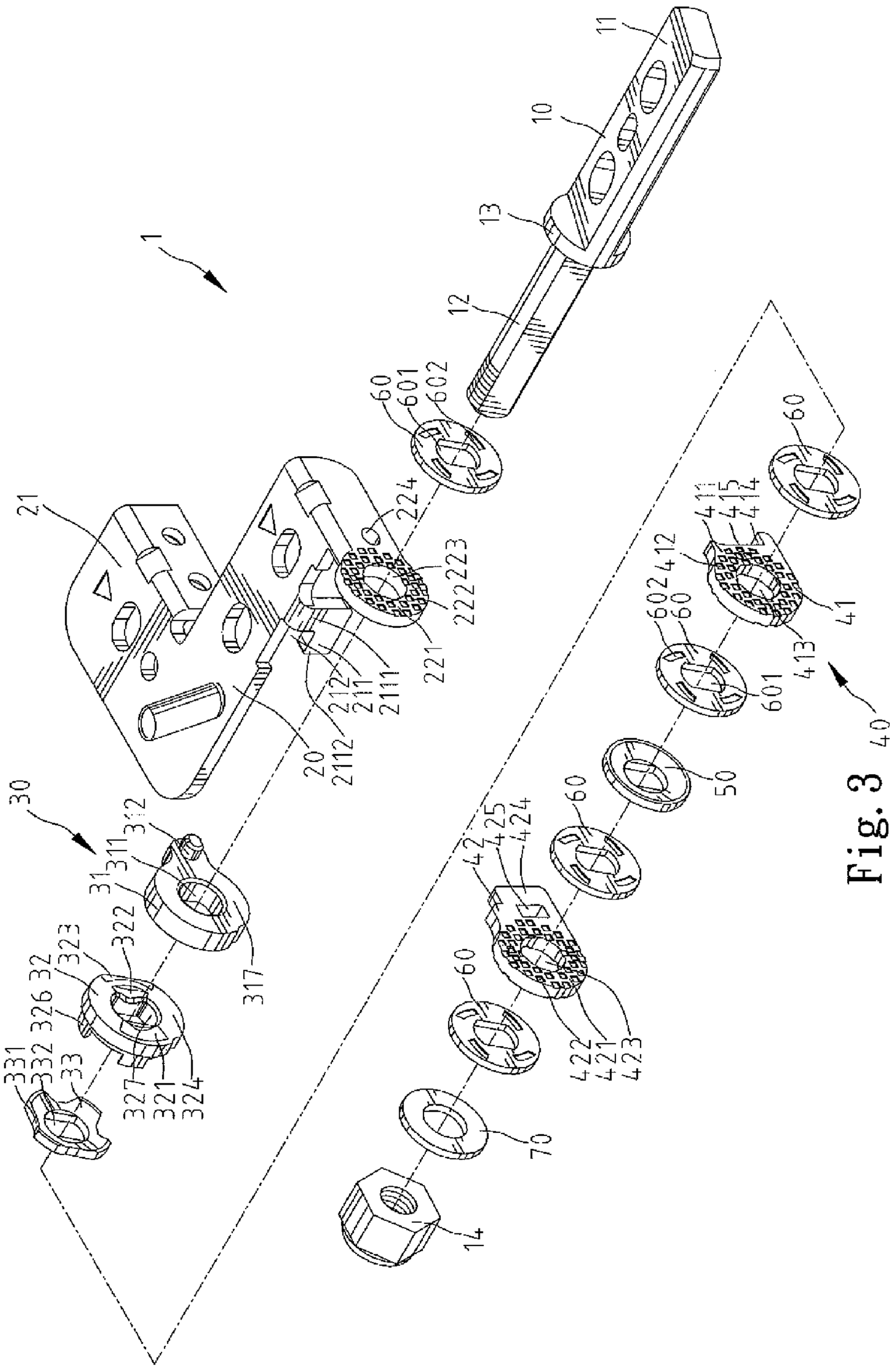

1
11
10
13
12
60
601
602
224
21
222
223
221
2112
211
2111
20
30
31
311
312
322
323
32
326
331
332
33
327
321
324
317
42
425
424
50
70
14
411
415
412
413
41
422
421
423
40

Fig. 3

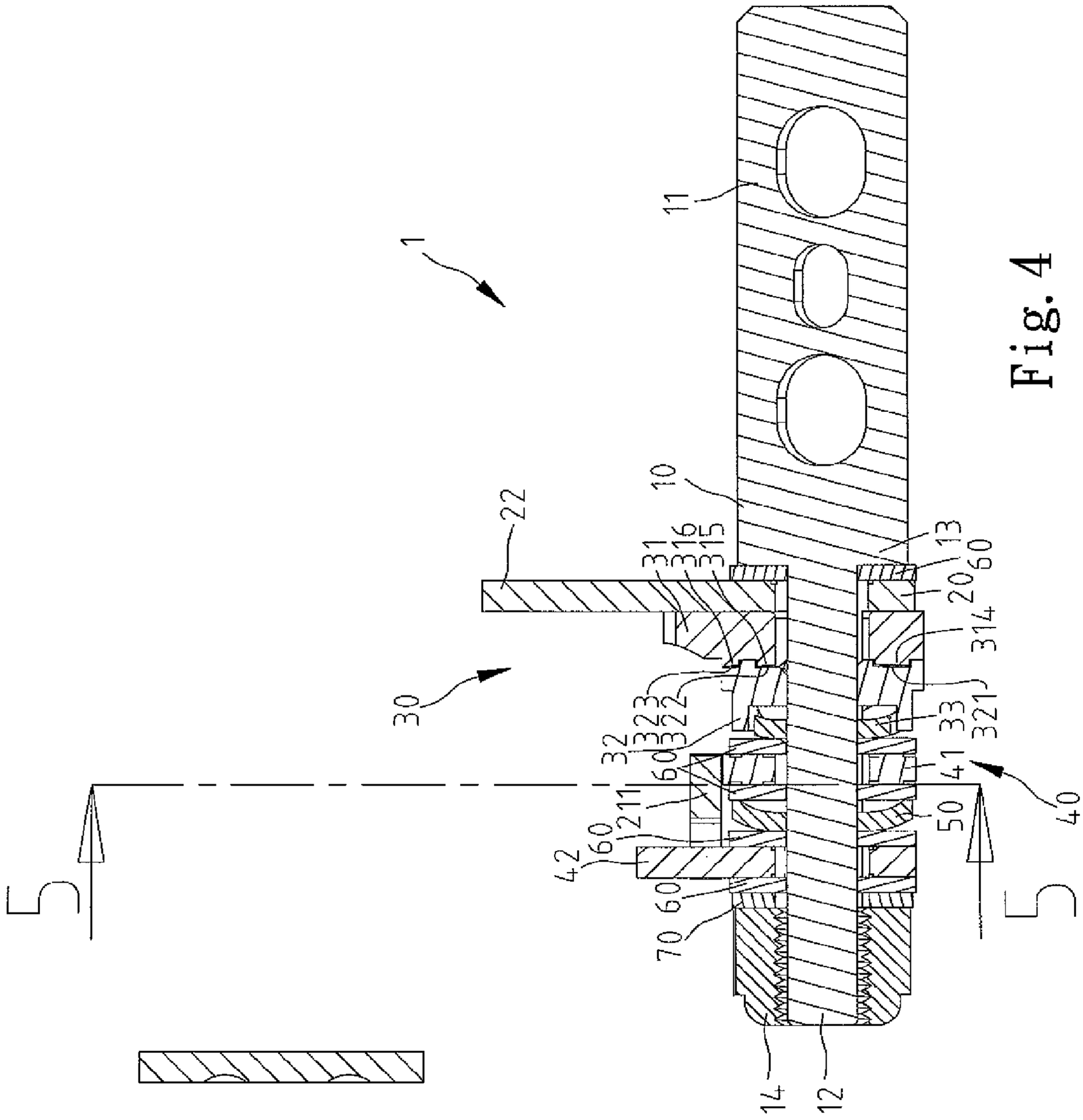

1
11
10
22
31
316
315
13
60
20
314
30
323
322
321
33
32
60
41
211
50
40
60
42
60
70
14
12
5
5

Fig. 4

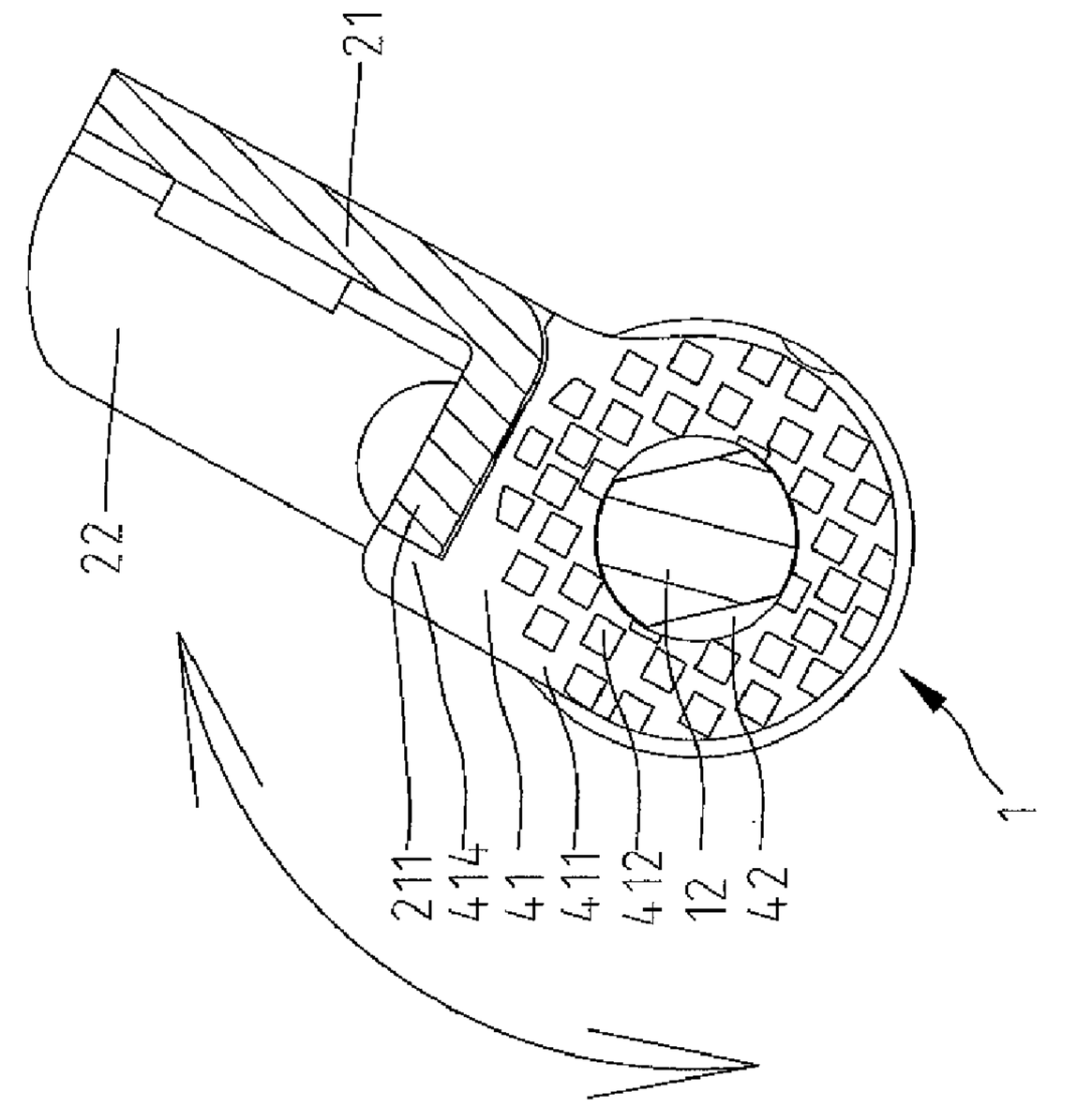


Fig. 8

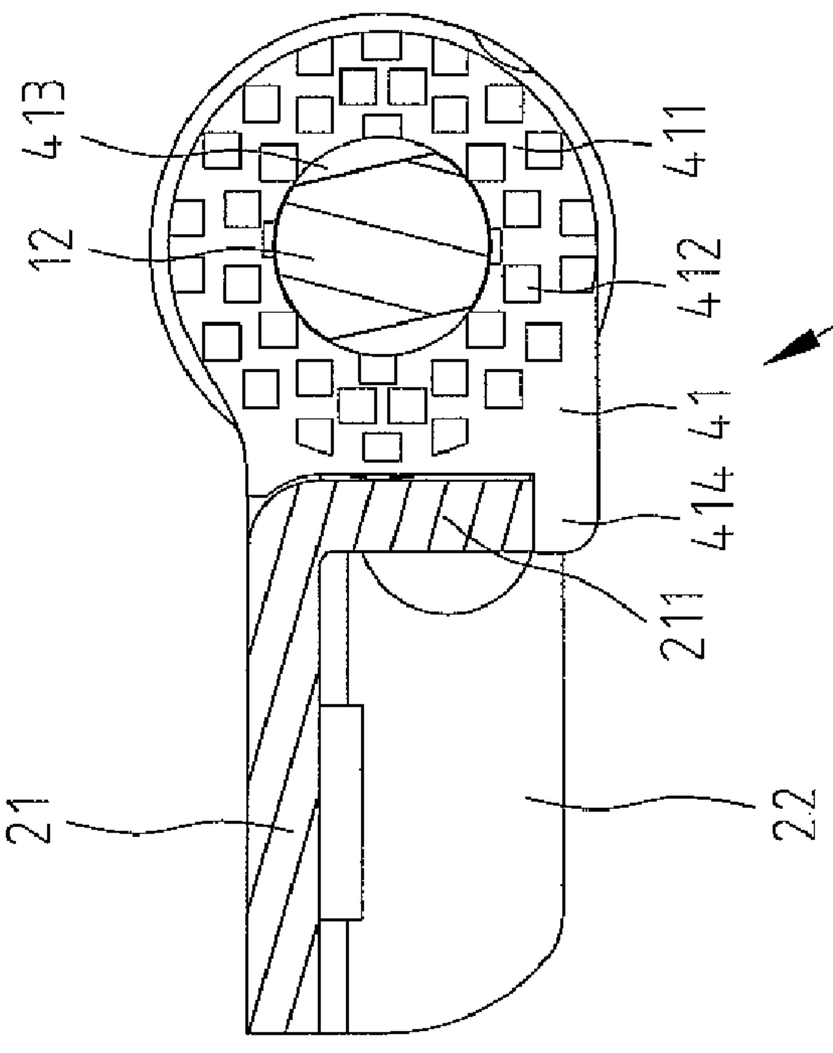


Fig. 5

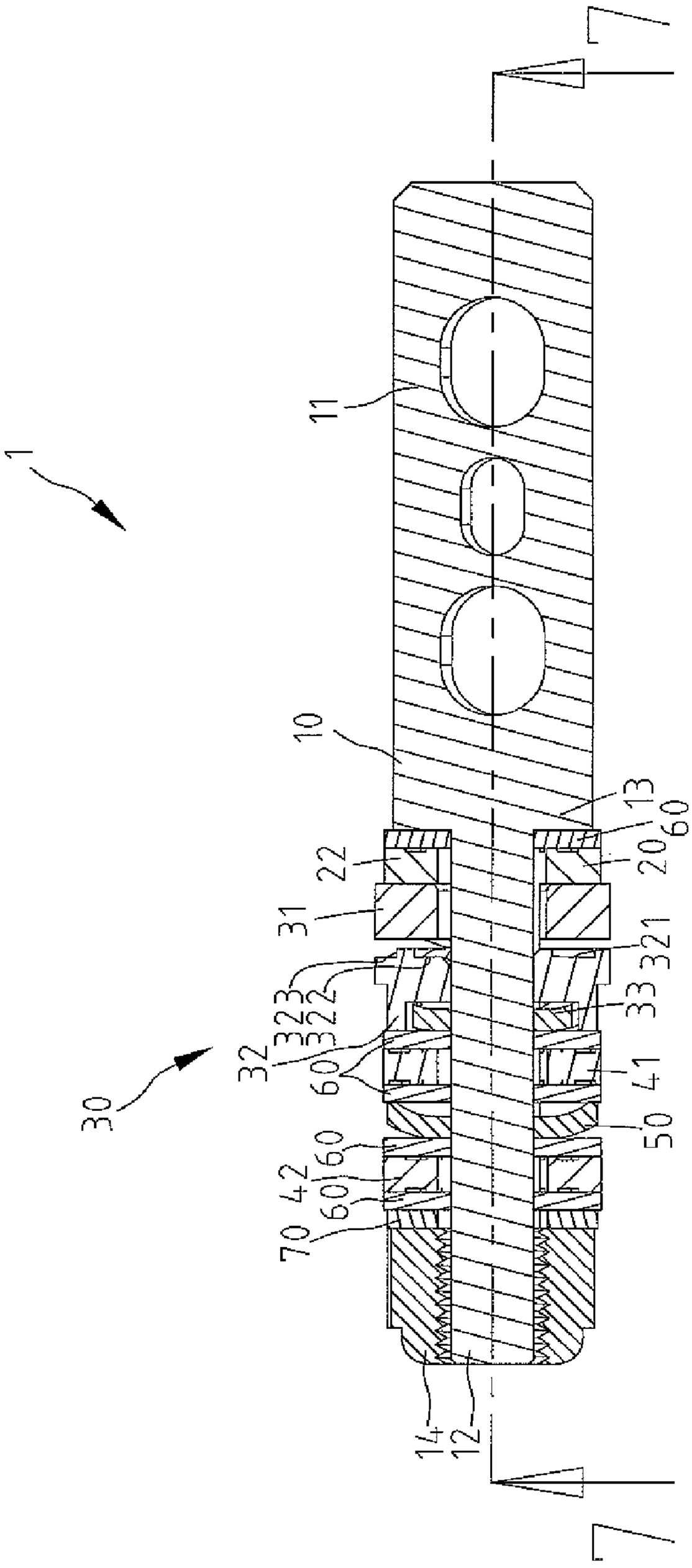


Fig. 6

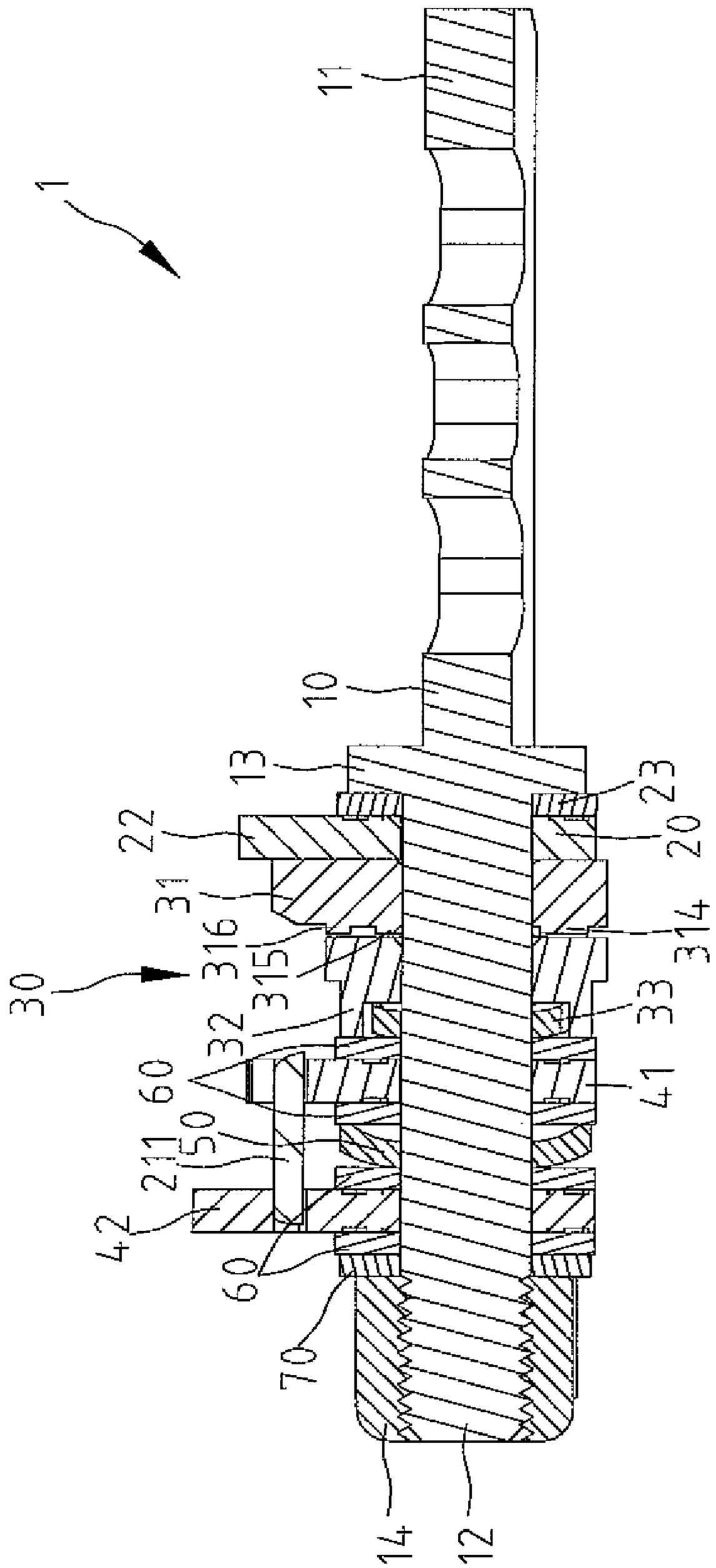


Fig. 7

HINGE ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a hinge assembly and, in particular, to a hinge assembly for electronic apparatus.

2. Description of the Related Art

Referring to Taiwan Patent Publication No. 556,861, there is disclosed a hinge mechanism for supporting a display at various angular positions relative to a base. The hinge mechanism includes a first coupling member **10** for coupling to the base, a second coupling member **20** for coupling to the display, and two resilient members **30** disposed oppositely and frictionally rotatable with respect to a wall of the second coupling member **20** for supporting the display at various angular positions with respect to the base. However, a problem with such hinge mechanism is that torque and pressure load transmitted to the resilient members **30** can break the resilient members **30** easily.

The present invention is, therefore, intended to obviate or at least alleviate the problems encountered in the prior art.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a hinge assembly that increases life of components and that is used for supporting a display at various angular positions relative to a base.

Accordingly, the object is achieved by providing a hinge assembly that includes a first coupling member for coupling to the base and a second coupling member for coupling to the display. A positioning device supports the display at various angular positions relative to the base. A friction device increases resistance to movement throughout the range of motion of the hinge assembly while decreasing torque and pressure load transmitted to the positioning device. A biasing member imparts biasing force to the positioning device and the friction device, and a plurality of lubricating washers lubricates the friction device.

There has thus been outlined, rather broadly, the more important features of the invention in order that the detailed description thereof that follows may be better understood and in order that the present contribution to the art may be better appreciated. There are additional features of the invention that will be described hereinafter and which will form the subject matter of the claims appended hereto.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a hinge assembly in accordance with a first embodiment of the present invention.

FIG. **2** is an exploded perspective view of the hinge assembly of FIG. **1**.

FIG. **3** is an exploded perspective view of the hinge assembly of FIG. **1** taken from a different angle of view.

FIG. **4** is a cross-sectional view taken along line **4-4** of FIG. **1**.

FIG. **5** is a cross-sectional view taken along line **5-5** of FIG. **4**.

FIG. **6** is similar to FIG. **4**, but shows the hinge assembly in another position.

FIG. **7** is a cross-sectional view taken along line **7-7** of FIG. **6**

FIG. **8** is similar to FIG. **5**, but shows the hinge assembly in another position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. **1** through **4**, a hinge assembly **1** suitable for coupling a notebook computer base to a display includes a first coupling member **10** for coupling to the base, a second coupling member **20** for coupling to the display, a positioning device **30** for supporting the display at various angular positions relative to the base, a friction device **40** for increasing resistance to movement throughout the range of motion of the hinge assembly **1** while decreasing torque and pressure load transmitted to the positioning device **30**, a biasing member **50** for imparting biasing force to the positioning device **30** and the friction device **40**, and a plurality of lubricating washers **60** for lubricating the friction device **40**.

The first coupling member **10** has a first section **1**, a second section **12** and a shoulder **13** formed therebetween. The second section **12** pivotally receives the positioning device **30**, the friction device **40**, the biasing member **50**, and the plurality of lubricating washers **60** and threadly engages with an end cap **14** for retaining the aforementioned elements **30**, **40**, **50**, **60** on the second portion **12**. Furthermore, a spacer **70** is provided between one of the plurality of lubricating washers **60** and the end cap **14** so as to prevent the end cap **14** from fretting the lubricating washer **60**.

The second coupling member **20** includes a connection end **21** and a pivotal end **22** extended from the connection end **21**. The pivotal end **22** includes a hole **223** in which the second section **12** of the first coupling member **10** is inserted and can be rotated with respect to the second section **12** of the first coupling member **10**. The pivotal end **22** further includes a friction face **221** facing the shoulder **13**, and the friction face **221** has a plurality of dents **222** for keeping lubricant. Furthermore, an anchor **211** has a first portion **2111** extended from the connection end **21** and a second portion **2112** extended from the first portion **2111**. Since the second portion **2112** is spaced from the connection end **21**, a gap **212** is defined between the connection end **21** and the second portion **2112**.

The positioning device **30** includes a first detent **31** having a first face **313** and a second face **317** and a hole **311** transversely extending therebetween and that receives the second section **12** of the first coupling member **10** and can be rotated with respect to the second section **12** of the first coupling member **10**. The first face **313** has a first ridge **314**, a second ridge **315**, and a third ridge **316** disposed at different radii from the hole **311**, and the second and third ridges **315** and **316** are opposite to the first ridge **314**. The second face **317** has a catch **312** extended therefrom and that is received in an orifice **224** so that when the second coupling member **20** rotates, the first detent **31** and the second coupling member **20** can be rotatable together.

The positioning device **30** further includes a second detent **32** having a first face **324**, a second face **325** and a hole **327** transversely extending therebetween and that receives the second section **12** of the first coupling member **10** and can be rotated in concert with the second section **12** of the first coupling member **10**. The first face **324** has a first indentation **321**, a second indentation **322**, and a third indentation **323** formed thereon complementally receivable in the first, second, third ridges **314**, **315**, **316**, respectively. The second face **325** has four stubs **326** formed thereon. Furthermore, the positioning device **30** includes a resilient member **33** positioned against the second face **325**. The resilient member **33** is

formed in a shape of a dome with a predetermined curvature and includes four recessed edges **331** and a hole **332**. The four recessed edges **331** correspondingly surround the four stubs **326** of the second face **325** respectively. The hole **332** allows insertion of the second section **12** of the first coupling member **10**.

The friction device **40** includes a first friction member **41** having two opposed friction faces **411** and a hole **413** transversely extending therebetween and that receives the second section **12** of the first coupling member **10** and can be rotated with respect to the second section **12** of the first coupling member **10**. Each friction face **411** has a plurality of dents **412** for keeping lubricant. In addition, the first friction member **41** includes a protrusion **414** and a space **415** delimiting a portion of the periphery of the first friction member **41** and a portion of the protrusion **414** that slidably receives the second portion **2112** of the anchor **211** of the second coupling member **20**.

The friction device **40** further includes a second friction member **42** having two opposed friction faces **421** and a hole **423** transversely extending therebetween and that receives the second section **12** of the first coupling member **10** and can be rotated with respect to the second section **12** of the first coupling member **10**. Each friction face **421** has a plurality of dents **422** for keeping lubricant. In addition, the second friction member **42** includes an extension **424** having an orifice **425** extending therethrough and that slidably receives the second portion **2112** of the anchor **211** of the second coupling member **20**.

The sliding movement of the first and second friction members **41** and **42** are dependent upon engagement/disengagement of the first, second, and third ridges **314**, **315**, **316** with the first, second, and third indentations **321**, **322**, **323**, respectively, and the biasing member **50** is suitable for urging the second detent **32** towards the first detent **31**.

Each of the plurality of lubricating washers **60** includes two opposed faces having a plurality of radially disposed recesses **602** for keeping lubricant individually and a hole **601** transversely extending therebetween and that receives the second section **12** of the first coupling member **10**. The recesses **602** are each of an arcuate shape so as to achieve ease of movement throughout the range of motion of the hinge assembly.

In this preferred embodiment, two lubricating washers **60** are positioned on the two friction faces **411** of the first friction member **41** respectively, and two lubricating washers **60** are positioned on the two friction faces **421** of the second friction member **42** respectively. One lubricating washer **60** is positioned between the pivotal end **22** of the second coupling member **20** and the shoulder **13** of the first coupling member **10**.

Referring to FIGS. **4** and **5**, when the hinge assembly is in a closed state, the first, second, and third ridges **314**, **315**, **316** of the first detent **31** are completely received in the first, second, and third indentations **321**, **322**, **323** of the second detent **32**, respectively.

Referring to FIGS. **6** through **8**, when gradually opening the hinge assembly, the second coupling member **20** is rotated relative to the first coupling member **10**. The first, second, and third ridges **314**, **315**, **316** of the first detent **31** are gradually rotated to disengage from the first, second, and third indentations **321**, **322**, **323** of the second detent **32**, respectively, The first and second friction members **41** and **42** are rotated relative to the lubricating washers **60** so as to increase resistance to movement throughout the range of motion of the hinge assembly **1** and are slidably moved along the second portion **2112** of the anchor **211** of the second coupling member **20** so as to decrease torque and pressure load transmitted to the positioning device **30**.

While the invention has been described with respect to a certain specific embodiment, it will be appreciated that many modifications and changes may be made by those skilled in the art without departing from the spirit of the invention. It is intended, therefore, by the appended claims to cover all such modifications and changes as fall within the true spirit and scope of the invention.

What is claimed is:

1. A hinge assembly comprising:

a first coupling member including a first section and a second section;

a second coupling member pivotally connected to the second section of the first coupling member and including an anchor extended therefrom;

a positioning device connected to the second section of the first coupling member, with the positioning device including a first detent pivotal with respect to the first coupling member, a second detent rotatable in concert with the first coupling member and a resilient member, with the first detent including at least one ridge formed on a first face, with the second detent including at least one indentation formed on a first face corresponding to the at least one ridge respectively, with the resilient member being formed in a shape of a dome with a predetermined curvature positioned on a second surface of the second detent;

a friction device pivotally connected to the second section of the first coupling member and including a first friction member and a second friction member both slidably engaged with the anchor; and

a biasing member connected to the second section of the first coupling member and imparting a biasing force to the positioning device and the friction device;

wherein the second coupling member is rotatable with respect to the first coupling member;

wherein the second detent is rotatable with respect to the first detent and the at least one ridge is selectively engagable with the at least one indentation respectively in order to position the second coupling member at a pivot angle with respect to the first coupling member;

wherein the first and second friction members are moved to provide friction to relative movement of the first and second coupling members; and

wherein sliding movement of the friction device is dependent upon engagement and disengagement of the at least one ridge with the at least one indentation respectively.

2. The hinge assembly as claimed in claim **1** wherein the anchor comprises a first portion extended from the second coupling member and a second portion extended from the first portion and spaced from the second coupling member.

3. The hinge assembly as claimed in claim **2** wherein the first friction member comprises a protrusion and a space delimiting a portion of a periphery of the first friction member and a portion of the protrusion for receiving the second portion of the anchor.

4. The hinge assembly as claimed in claim **2** wherein the second friction member comprises an extension having an orifice for receiving the second portion of the anchor.

5. The hinge assembly as claimed in claim **1** wherein the first and second friction members comprise two opposed friction faces individually, wherein each opposed friction face includes a plurality of dents formed thereon.

6. The hinge assembly as claimed in claim **5** wherein the first friction member comprises a protrusion and a space delimiting a portion of a periphery of the first friction member and a portion of the protrusion for receiving the second portion of the anchor.

7. The hinge assembly as claimed in claim **5** wherein the second friction member comprises an extension having an orifice for receiving the second portion of the anchor.

8. The hinge assembly as claimed in claim **1** further comprising a plurality of lubricating washers pivotally connected to the second section of the first coupling member, wherein each lubricating washer includes two opposed faces having a plurality of recesses.

9. The hinge assembly as claimed in claim **8** wherein each of the plurality of recesses is of an arcuate shape.

10. The hinge assembly as claimed in claim **1** wherein the first coupling member comprises a shoulder formed between the first and second sections.

11. The hinge assembly as claimed in claim **10** wherein the second coupling member comprises a pivotal end having a hole in which the second section of the first coupling member is inserted and a friction face facing the shoulder.

12. The hinge assembly as claimed in claim **11** wherein the friction face comprises a plurality of dents formed thereon.

13. The hinge assembly as claimed in claim **9** wherein the first friction member is positioned between two of the plurality of lubricating washers, and wherein the second friction member is positioned between another two of the plurality of lubricating washers.

14. The hinge assembly as claimed in claim **9** wherein the first coupling member comprises a shoulder formed between the first and second sections, and wherein the second coupling member comprises a pivotal end having a hole in which the second section of the first coupling member is inserted and a friction face facing the shoulder.

15. The hinge assembly as claimed in claim **14** wherein one of the plurality of lubricating washers is positioned between the friction face of the pivotal end and the shoulder.

* * * * *